Cattle Fever Tick Research Initiatives at Texas A&M University College Station

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Texas A&M AgriLife Research

Fever Tick Eradication Challenges

- Wildlife
  - Population densities
  - Large ranges
  - Limited or no treatment
- Changing land use
- Climate
- Funding
- Mexico

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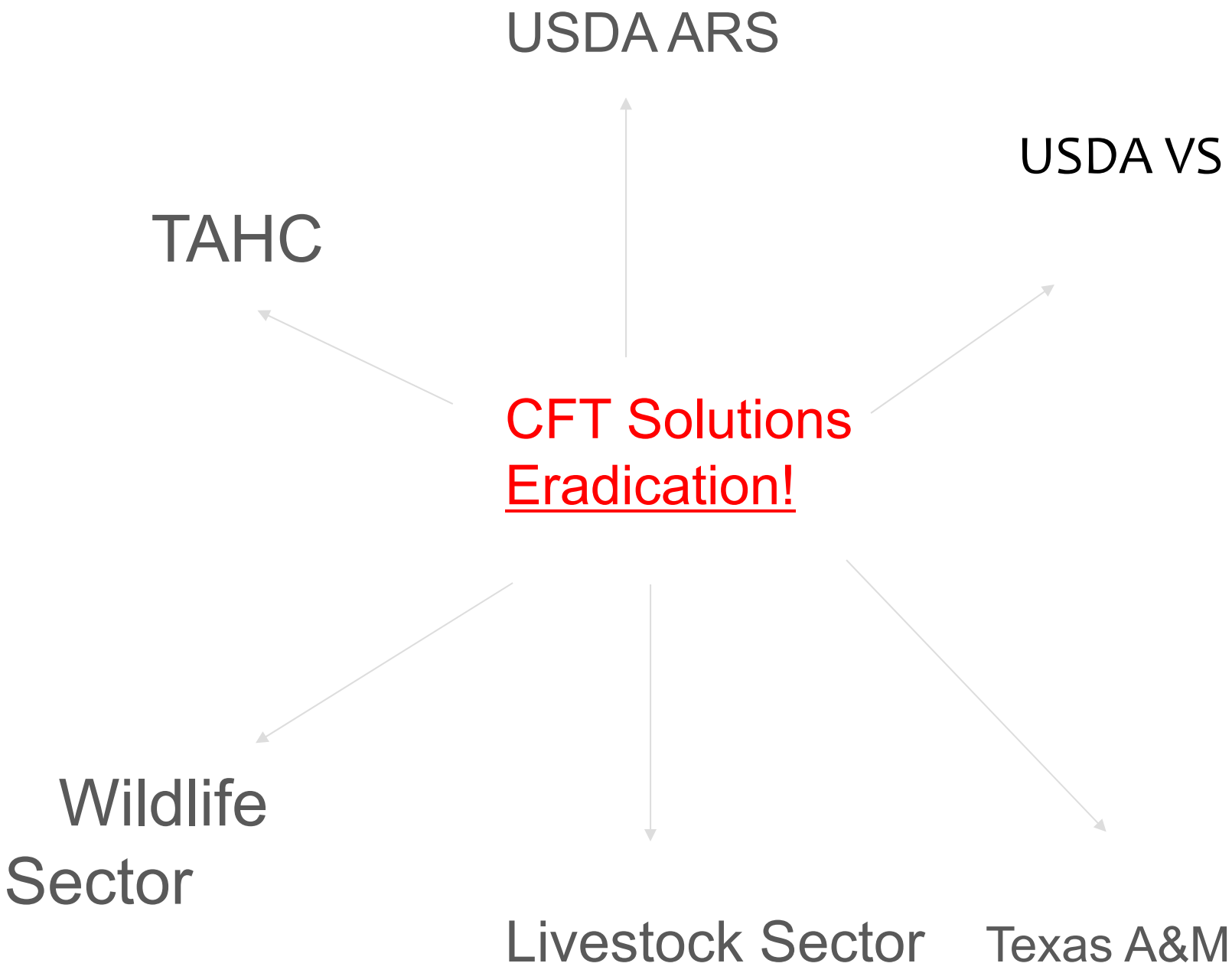
Research Needs

- Nilgai Antelope – any treatment method
- White-tailed deer – more treatment options
- Cattle – more treatment options with longer lasting effects
- Horses – more treatment options
- Equipment decontamination
- Pen and pasture treatment
- Vaccines for all hosts


USDA ARS
USDA VS
TAHC
CFT Solutions
Eradication!
Wildlife
Sector
Livestock Sector
Texas A&M

Integrated Research Needs List for CFT

- **Research Objectives/Solutions:**
- 1: Improve diagnostic detection of tick-infested/infected animals and pastures.
- 2: Develop alternative treatment methods for cattle.
- 3: Field treatments for horses, corrals, pens, and pasture loafing areas.
- 4: Develop methods for control of cattle fever ticks on nilgai antelope.
- 5. Improve effectiveness of treatments for infested deer.
- 6: Identify, evaluate and release biological control agents from native range of cattle fever ticks in Southeast Asia and Europe.
- 7: Discovery and testing of new vaccines for control of cattle fever ticks and Babesia pathogen.
- 8: Evaluation of rangeland vegetation that effects survival of cattle fever ticks.
- 9: Development of artificial rearing systems for ticks to accelerate testing of vaccines, acaricides and biological control agents.
- 10. Outreach to South Texas ranchers, hunters and landowners to integrate eradication tactics and document sustainability of best practices

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US Federal FY 2018 Omnibus

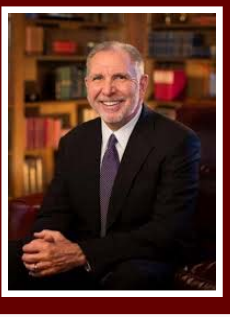
- Support for the Cattle Fever Tick Eradication Program (CFTEP) money disbursed by October 2018
  - **Accelerated research** projects discussed here
- Emphasis
  - New systematic treatment products with longer treatment intervals for cattle
  - New treatment products for wildlife, especially nilgai
  - New or improved preventative therapies, such as vaccines, for both cattle and wildlife hosts.

TEXAS A&M AGRILIFE RESEARCH

TAMU System Omnibus Funded Projects

- TAMU – College Station
  - Interaction of a long-acting eprinomectin product with Bm86 vaccination
  - Efficacy and Safety of doramectin with BM 86 vaccination
  - Development of cattle fever tick vaccine based on the P0 antigen
  - Multi-source data collection to enhance predictive modeling for the control of cattle
  - Tick-Host-Landscape-Weather Interactions drive Spatial-Temporal Dynamics of Cattle Fever Ticks

TEXAS A&M AGRILIFE RESEARCH



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Texas A&M Research partners (internal)

- Texas A&M System
  - AgriLife Research
  - AgriLife Extension
  - Texas Veterinary Diagnostic Lab (TVMDL)
  - College of Veterinary Medicine & Biomedical Sciences
  - Agriculture and Life Sciences
  - Texas A&M Engineering Extension Service(TEEX)
  - Texas A&M Kingsville

TEXAS A&M AGRILIFE RESEARCH

Development of Cattle Fever Tick Vaccine Based on the P0 Antigen

Collaborative Project - Sponsored by USDA, ARS

Principal Investigators:

Dee Ellis, Institute for Infectious Animal Diseases(IIAD)

Texas A&M AgriLife Research, College Station, TX

Maryn Ptaschinski, Institute for Infectious Animal Diseases

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Robert Miller, USDA, ARS,

Cattle Fever Tick Laboratory, Edinburg, TX

TEXAS A&M AGRILIFE RESEARCH

Development of Cattle Fever Tick Vaccine Based on the P0 Antigen

- Cuba Provides “formula” for patented P0 antigen
- Vaccine recreated
  - Amplification and sequencing of cDNA
  - P0 sequencing alignment
  - Protein Synthesis begins
  - Vaccine formulated
- Cattle vaccinated at TAMU College Station
- Blood collected
- Tick Artificial feeding begins
- Assessment of results determined

TEXAS A&M AGRILIFE RESEARCH

Interaction of a long-acting eprinomectin product (LONGRANGE®) with Bm86 vaccination against cattle fever ticks

Collaborative Project - Sponsored by USDA, ARS

Principal Investigators:

Dee Ellis, Institute for Infectious Animal Diseases(IIAD)

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TEXAS A&M AGRILIFE RESEARCH

Interaction of a long-acting eprinomectin product (LONGRANGE®) with Bm86 vaccination against cattle fever ticks

PART 1

1. Controlled Field Study – 4 field test combinations (6 cattle each)
   a. Control (saline injections)
   b. Vaccinated only (Bm86 proprietary Zoetis vaccine)
   c. Treated with eprinomectin only
   d. Vaccinated and treated combination
2. Cattle infested with ticks 4 weeks after injection
3. Tick counts and blood drawn weekly
4. Experiment stops when less than 90% efficacy for 3 days
5. Eprinomectin blood concentration analysis at UTSA

TEXAS A&M AGRILIFE RESEARCH

Interaction of a long-acting eprinomectin product (LONGRANGE®) with Bm86 vaccination against cattle fever ticks

PART 2

1. Natural Infestation Case–Study field 3 replicate test combinations (12 cattle each)
   a. Infested with 2500 larvae ticks
   b. Vaccinated day 0 and 28(Bm86 proprietary Zoetis vaccine)
   c. Treated with eprinomectin twice 30 days apart
2. Weekly tick counts and blood drawn weekly
3. Experiment stops when tick count rises to 30 standard females per animal or 180 days post initial treatment
4. Eprinomectin blood concentration analysis at UTSA

TEXAS A&M AGRILIFE RESEARCH

Efficacy and Safety Studies using 1% Doramectin and BM 86 based Vaccine

Collaborative Project - Sponsored by USDA, ARS

Principal Investigators:

Dee Ellis, Institute for Infectious Animal Diseases(IIAD)

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TEXAS A&M AGRILIFE RESEARCH

Efficacy and Safety Studies using 1% Doramectin and BM 86 based Vaccine

Part 1

- Standard Barn Trial
  - Cattle infested with ticks
  - Animals treated with
    - Doramectin or,
    - BM 86 vaccine or,
    - Doramectin and BM 86 vaccine
  - Ticks studied for counts and fecundity
  - Trial stops when control drops below 90%

Texas A&M AgriLife Research

Efficacy and Safety Studies using 1% Doramectin and BM 86 based Vaccine

Part 2

- Field Trial – infested pasture
  - Cattle infested with ticks
  - Animals treated with
    - Doramectin or,
    - BM 86 vaccine or,
    - Doramectin and BM 86 vaccine
  - Ticks studied for counts and fecundity
  - Trial stops when control drops below 90%

Texas A&M AgriLife Research

Multi-Source Data Collection to Enhance Predictive Modeling for the Control of Cattle Fever Ticks

Collaborative Project - Sponsored by USDA, ARS

Principal Investigators:

Pete D. Teel, Entomology,

Texas A&M AgriLife Research, College Station, TX

Robert Miller, USDA, ARS,

Cattle Fever Tick Laboratory, Edinburg, TX

Kimberly Lohmeyer, USDA, ARS,

Knipling-Bushland U.S. Livestock Insects Research Laboratory, Kerrville, TX

TEXAS A&M AGRILIFE RESEARCH

Tick-Host-Landscape-Weather Interactions drive Spatial-Temporal Dynamics of Cattle Fever Ticks

Objectives:

1. Certify & validate existing models
2. Refine existing and identify new ecological interactions for tactical applications
3. Demonstrate real-time applications of weather-driven models for cattle fever tick population dynamics
4. Provide platform for exploration and testing new concepts for tick suppression

TEXAS A&M AGRILIFE RESEARCH

Tick-Host-Landscape-Weather Interactions drive Spatial-Temporal Dynamics of Cattle Fever Ticks

Integrated Technologies - South Texas Rangeland

- GIS platform (vegetation, topography, physiography)
- GPS tracking of cattle on tick infested rangeland
- Meso- & microclimate weather monitoring
- Aerial drone animal census and habitat assessment
- Robotic tick surveillance and refugia assessment
- Tick simulation model validation

Texas A&M AgriLife Research

Nilgai Modeling –

Evaluation of host role in dispersal and population dynamics of *Rhipicephalus microplus*

Collaborative Project - Sponsored by USDA, ARS

Pete D. Teel, Hsiao-Hsuan Wang, William E. Grant,

Entomology & Wildlife & Fisheries Sciences,

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Kimberly Lohmeyer and Adalberto Perez de Leon,

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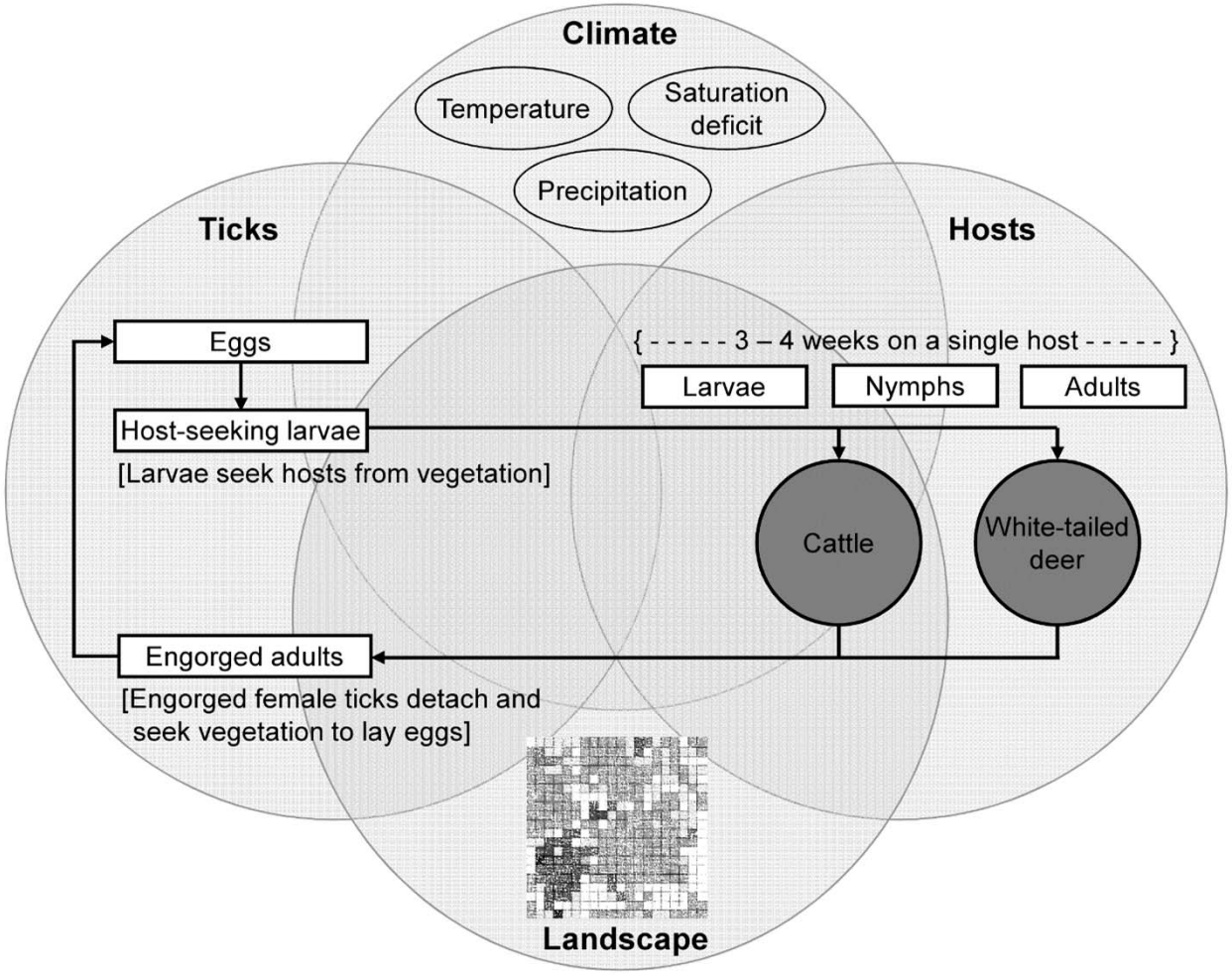
Nilgai Modeling –

Building a new host into an existing cattle and white-tailed deer model, using spatially-explicit, individual-based, stochastic simulation.



Hsiao-Hsuan Wang, Pete D. Teel, William E. Grant, Greta Schuster, A.A. Pérez de León. 2016. Ecological Modelling 342:86-96.

TEXAS A&M AGRILIFE RESEARCH

Nilgai Modeling –

Modeling Objectives:

1. Establish the threshold ratio of nilgai-to-cattle for sustaining cattle fever tick populations
2. Assess overlapping host-habitat usage in formation of tick refugia
3. Evaluate spatial-temporal overlap between nilgai and cattle to determine efficacy of cattle as a “trap host”
4. Determine whether nilgai communal dung piles could be exploited for tick suppression tactics

Texas A&M AgriLife Research

TAMU System Omnibus Funded Projects

- TAMU – Kingsville
  - Development and testing of remote activated ultra-quiet field sprayer for eradication of cattle fever ticks on nilgai and white-tailed deer
  - Field evaluation of protein feeder acceptance by naïve and trained nilgai and interactions with white-tailed deer
- University of Texas Rio Grande Valley
  - Host Range Testing of Cattle Fever Tick Biological Control Agents

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Haemaphysalis longi

or

Longhorned Tick

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